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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Application of: Group Art Unit: 1732
Applicant: Jay A. Morrison, et al. Examiner: Wollschlager, J. M.
Serial No.: 10/767,012 Atty. Docket: 2003P17581US
Filed: 01/29/2004 Confirmation No. 4734
Title: METHOD OF MANUFACTURING A HYBRID STRUCTURE

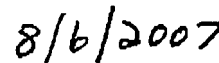
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This Certificate of Facsimile Transmission (1 page)
Fee Transmittal (1 page)
Appellant's Brief Under 37 CFR 41.37 (17 pages)





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☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$) 600.00

Complete if Known

Application Number 10/787,012
Filing Date 01/28/2004
First Named Inventor Jay A. Morrison
Examiner Name Jeffrey M. Wollschlaeger
Art Unit 1732
Attorney Docket No. 2003P17581US

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☒ Deposit Account Deposit Account Number 18-2179 Deposit Account Name: Siemens Corporation

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☒ Charge fee(s) indicated below

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES		SEARCH FEES		EXAMINATION FEES		Fees Paid (\$)
	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description

Each claim over 20 (including Reissues)

Fee (\$)

Small Entity Fee (\$)

Each independent claim over 3 (including Reissues)

50

25

Multiple dependent claims

200

100

Total Claims

Extra Claims

Fee (\$)

Fee Paid (\$)

Multiple Dependent Claims

Fee (\$)

Fee Paid (\$)

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims

Extra Claims

Fee (\$)

Fee Paid (\$)

HP = highest number of independent claims paid for, if greater than 3

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets Extra Sheets Number of each additional 50 or fraction thereof Fee (\$)

- 100 = / 50 = (round up to a whole number) x = Fee Paid (\$)

4. OTHER FEE(S)

Non-English Specification, \$130 fee (no small entity discount)

Other (e.g., late filing surcharge): Filing a Brief in Support or Appeal 37 CFR 41.20(b)(2)

Fees Paid (\$)

500.00

SUBMITTED BY

Signature

Name (Print/Type) John P. Muscare

Registration No.

(Attorney/Agent) 44,061

Telephone 407-736-8449

Date 8/6/07

This collection of information is required by 37 CFR 1.196. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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In re: Application of:

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Title: METHOD OF MANUFACTURING A HYBRID STRUCTURE

Mail Stop Appeal Brief - Patent
COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPELLANT'S BRIEF UNDER 37 CFR 41.37

This brief is in furtherance of the Notice of Appeal filed in this application on June 4, 2007. A Fee Transmittal form PTO/SB/17 is transmitted concurrently with this paper to authorize the payment of the fee required for submittal of this brief.

1. REAL PARTY IN INTEREST - 37 CFR 41.37(c)(1)(i)

The real party in interest in this Appeal is the assignee Siemens Power Generation, Inc.

2. RELATED APPEALS AND INTERFERENCES - 37 CFR 41.37(c)(1)(ii)

There is no other appeal, interference or judicial proceeding that is related to or that will directly affect, or that will be directly affected by, or that will have a bearing on the Board's decision in this Appeal.

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3. STATUS OF CLAIMS - 37 CFR 41.37(c)(1)(iii)

Claims pending: 1-3 and 5-18.

Claims cancelled: 4.

Claims withdrawn but not cancelled: none.

Claims allowed: none.

Claims objected to: none.

Claims rejected: 1-3 and 5-18.

The claims on appeal are 1-3 and 5-18.

4. STATUS OF AMENDMENTS - 37 CFR 41.37(c)(1)(iv)

No amendment was filed subsequent to the final rejection.

5. SUMMARY OF THE CLAIMED SUBJECT MATTER- 37 CFR 41.37(c)(1)(v)

The present invention is directed generally to a method of manufacturing a hollow component, such as the gas turbine transition duct 10 of FIG. 1, when the inner portion of the component is formed of a structurally weak material (e.g. a layer of ceramic insulating material 18). The present inventors have discovered and are claiming a manufacturing process whereby an inner mold accomplishes two functions: 1) to define the inner dimensions of the hollow component during a casting step (FIG. 3), and 2) to support the structurally weak material after the casting step when a mechanical operation is being performed on the outside surface of the weak material (FIG. 5). The process is advantageously used when a relatively thin thickness of the weak material is desired, but it is necessary to cast the weak material in a greater thickness due to specific casting property of the material, then to machine it down to the desired thin thickness after it is cast, as described in the specification at page 3, lines 15-32.

Independent claim 1 is directed to a method of manufacturing as illustrated in FIGs. 2-7. The method includes defining a cavity 16 between an inner mold 14 and an outer mold 12, the inner mold comprising a fugitive material portion 20, as described in the specification at page 2, lines 7-20. The method of claim 1 further includes casting a layer of ceramic insulating material 18 within the cavity, as described at page 2, lines 11-12, then removing the outer mold 12, as described at page 3, lines 28-30. The method further includes performing a mechanical process

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on the layer of ceramic insulating material 18 while the inner mold 14 remains in place for mechanically supporting the layer of ceramic insulating material 18, as described at page 3, line 30-32, then removing the fugitive material 20 and removing the inner mold 14, as described at 2, lines 29-32. Claim 1 further specifies that the step of performing a mechanical process comprises machining the layer of ceramic insulating material to a predetermined thickness, as described in the specification at page 3, line 15 through page 4, line 3.

Independent claim 8 is directed to a method of manufacturing as illustrated in FIGs. 2-7. The method includes defining a cavity 16 between an inner mold 14 comprising a fugitive material portion 20 and an outer mold 12, as described in the specification at page 2, lines 7-20. The method also includes casting a layer of ceramic insulating material 18 within the cavity, as described at page 2, lines 11-12, then removing the outer mold 12; as described at page 3, line 28-30. The method further includes performing a mechanical process on the layer of ceramic insulating material 18 while the inner mold 14 remains in place for mechanically supporting the layer of ceramic insulating material, as described at page 3, line 30-32, then removing the fugitive material 20 and removing the inner mold 14, as described at 2, lines 29-32. Claim 8 further includes at least partially curing the layer of ceramic insulating material 18 after the inner mold 14 has been removed; and installing a second inner mold 14 comprising a fugitive material portion for supporting the ceramic insulating material 18 during a subsequent process step, as described at page 4, line 25 through page 5, line 2.

Independent claim 11 is directed to a method of manufacturing a gas turbine component, the component comprising a ceramic matrix composite material member defining a passageway and a layer of ceramic insulating material protecting the ceramic matrix composite member from high temperature gas passing through the passageway (e.g. the insulating material on the inside surface of the hollow component). The method is illustrated in FIGs. 2-7. The method includes defining an annular cavity 16 having a first thickness dimension T between an inner mold 14 and an outer mold 12, as described in the specification at page 2, lines 7-20. The method further includes casting ceramic insulating material 18 within the cavity to have the first thickness dimension T, as described at page 2, lines 11-12, then removing the outer mold; as described at page 3, line 28-30. The method further includes removing a portion of the ceramic insulating material 18 to reduce the ceramic insulating material to a second thickness dimension smaller than the first thickness dimension T while the inner mold 14 remains in place mechanically

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supporting the ceramic insulating material, as described at page 3, line 30-32. The method further includes forming a layer of ceramic matrix composite material 28 on an outer surface of the ceramic insulating material 18; and then removing the inner mold 14, as described at page 4, lines 4-17.

6. GROUNDS OF REJECTION TO BE REVIEWED UPON APPEAL - 37 CFR 41.37(c)(1)(vi)

A. Claims 1 and 5-9 stand finally rejected under 35 USC 102(b) as being anticipated by Cornie (WO 01/21344).

B. Claims 1 and 5-7 stand finally rejected under 35 USC 103(a) as being unpatentable over Li (US 6,350,404).

C. Claims 2, 3, 11-13 and 16-18 stand finally rejected under 35 USC 103(a) as being unpatentable over Lie in view of Owen (US 5,881,775).

D. Claims 2, 3 and 10-18 stand finally rejected under 35 USC 103(a) as being unpatentable over Cornie in view of Ress (US 5,378,110) or Kobashi (US 6,830,724).

7. ARGUMENT 37 CFR 41.37(c)(1)(vii)

A. Why Cornie fails to anticipate claims 1 and 5-9

Arguments applicable to all claims in this group (1 and 5-9):

i) Independent claim 1 is exemplary of this group of claims in that it includes the limitation of "performing a mechanical process on the layer of ceramic insulating material while the inner mold remains in place for mechanically supporting the layer of ceramic insulating material." The inner mold is removed in a later step of the claim after the mechanical process is performed. Cornie fails to describe any such mechanical process being done while an inner mold remains in place.

On page 2 of the final Office Communication dated 03/06/2007 where the Examiner provides detailed line and page references from Cornie to explain where he draws support for the teaching of the various claim limitations, it is conspicuous that no line or page reference is provided to cite specifically where Cornie teaches the above-cited claim step. The rejections under 35 USC 102 are not supported by the art and should be overturned.

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ii) Cornie describes a method for manufacturing a cast component that has an outer shape defined by preform 10. By necessity, the part produced by the method of Cornie is a solid part, since the space defined by the preform 10 defines the part. In contrast, the present invention is a process for producing a hollow part. The Examiner argues on page 13 of the final Office Communication that "1. The instant claims are not limited to a process of producing hollow final products." The Examiner's statement is erroneous, since when a ceramic insulating material 18 is cast in a cavity around an inner mold 14, and the inner mold 14 is then removed, the resulting part must necessarily be hollow because there will be an empty space where the inner mold 14 had previously existed.

Arguments applicable only to claims 1 and 5-7:

Independent claim 1 includes the limitation of "wherein the step of performing a mechanical process comprises machining the layer of ceramic insulating material to a predetermined thickness." Cornie fails to teach such steps.

On page 2 and continuing onto page 3 of the final Office Communication, the Examiner cites three sections of Cornie that allegedly teach this limitation. An examination of these sections of Cornie reveals that they do not teach this limitation, as follows:

- page 4, lines 19-24 states that the order of steps is immaterial so long as the invention remains operable
- page 6, lines 16-25 provides a definition of "net-shape"
- page 25, lines 20-28 describes various machining and processing steps that are performed after the cast part is recovered from the mold. None of these steps involve machining a layer of ceramic insulating material to a predetermined thickness.

Thus, the rejection of independent claim 1 under 35 USC 102 is not supported by the art and should be overturned. Accordingly, the rejection of dependent claims 5-7 should also be overturned.

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Arguments applicable only to claims 8 and 9:

i) Independent claim 8 includes the limitations of "removing the fugitive material and removing the inner mold; at least partially curing the layer of ceramic insulating material after the inner mold has been removed; and installing a second inner mold comprising a fugitive material portion for supporting the ceramic insulating material during a subsequent process step." Cornie fails to teach this combination of steps.

On page 4 of the final Office Communication, the Examiner cites several sections of Cornie that allegedly teach this combination of limitations. An examination of these sections of Cornie reveals that they do not teach this limitation, as follows:

- page 10, line 28 to page 11, line 21 teaches the use of various types of patterns
- page 11, line 30 to page 12, line 11 teaches various mold release agents
- page 12, line 17-32 teaches attaching preforms and the use of fugitive coatings
- page 20, lines 15-22 teaches the removal of the fugitive coating on the pre-gates
- page 21, line 10 to page 22, line 2 teaches another embodiment of a preform of a gear.

None of these sections teach the claimed combination of partially curing a ceramic insulating material after an inner mold has been removed, and installing a second inner mold for supporting the ceramic insulation material during a subsequent process step. Thus, the rejection of independent claim 8 under 35 USC 102 is not supported by the art and should be overturned. Accordingly, the rejection of dependent claim 9 should also be overturned.

ii) In his remarks on page 13 of the final Office Communication, the Examiner states that "the claims are not limited to removing the first inner mold prior to installing the second inner mold." The Examiner points out that Cornie's preform may be filled with a fugitive material and may also be coated with a fugitive material, and he interprets these two layers of fugitive material as being two different inner molds. In this regard the Examiner is erroneous. First, claim 8 clearly requires a sequence of steps where a mechanical process is performed with an inner mold in place, then the partial curing of the ceramic material after the inner mold has been removed, and installing a second inner mold for supporting the ceramic material during a subsequent process step. This claimed sequence can only be satisfied when the first inner mold

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is removed prior to installing the second inner mold. Second, such a two-mold process is clearly not anticipated by a single mold having to layers of fugitive material. Thus, Cornie does not support the rejection of claim 8 or its dependent claim 9 under 35 USC 102.

B. Why Li fails to support the 35 USC 103 rejections of claims 1 and 5-7

Arguments applicable to all claims in this group (1 and 5-7):

The Examiner admits that Li fails to disclose the claim 1 step of "performing a mechanical process on the layer of ceramic insulating material while the inner mold remains in place for mechanically supporting the layer of ceramic insulating material." The Examiner states that it would have been obvious to have modified Li to keep the inner mold in place while a mechanical machining step is performed. However, the CCPA and Federal Circuit have consistently held that when a Section 103 rejection is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such a proposed modification is not proper and the *prima facie* case of obviousness cannot be properly made. Such is the case here.

Column 2, lines 49-64 of Li make it clear that it is essential to the Li invention to remove the inner mold very quickly (e.g. within 10 seconds by dissolving the foam insert in a solvent) as soon as the water disappears from the cast block and the green body is formed. This is necessary to avoid any build-up of stresses due to the drying shrinkage of the cast green body. These facts are established in the Li reference itself without any need for other evidence. Moreover, the Examiner's proposed modification of Li, i.e. to perform a machining operation while the inner mold remains in place, would certainly destroy the intent, purpose and function of the Li invention because it would significantly delay the removal of the inner mold. Accordingly, no *prima facie* case for the obviousness of independent claim 1 has been made, and the rejection of claims 1 and 5-7 should be overturned.

Arguments applicable only to claim 7:

Dependent claim 7 includes the further limitations of "at least partially curing the layer of ceramic insulating material prior to removing the inner mold." The Examiner argues on page 6 of the final Office Communication that the method of Li "intrinsically at least partially cures the layer of ceramic insulation material prior to removing the inner mold." The Examiner's position

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is erroneous. Li clearly teaches at column 2, lines 49-64 that his inner mold is removed very rapidly.

"As soon as the water disappears from the top of the slip-cast block, the green body, silicon nitride block is removed from the mold, box 20, and then immersed in a solvent for dissolving the insert, box 22. The solvent ... dissolves the polystyrene foam insert in less than 10 seconds."

Not only is this time frame extremely limited, but there is also no teaching of heating the green body ceramic material to an elevated curing temperature during this 10 second period. Thus, it is impossible for the ceramic material to partially cure prior to the removal of the inner mold, and no *prima facie* case for the rejection of claim 7 under 35 USC 103 has been established. This provides an additional basis for overturning this rejection of claim 7.

C. Why the combination of Li and Own fails to support the 35 USC 103 rejections of claims 2, 3, 11-13 and 16-18

Arguments applicable to all claims in this group (2, 3, 11-13 and 16-18):

Claim 11 is discussed herein as representative of the group as to this set of arguments only.

The Examiner admits that Li fails to disclose expressly the claim 11 step of performing a mechanical process while the inner mold remains in place. The Examiner states that it would have been obvious to have modified Li to keep the inner mold in place while a mechanical machining step is performed. However, the CCPA and Federal Circuit have consistently held that when a Section 103 rejection is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such a proposed modification is not proper and the *prima facie* case of obviousness cannot be properly made. Such is the case here.

Column 2, lines 49-64 of Li make it clear that it is essential to the Li invention to remove the inner mold very quickly (e.g. within 10 seconds by dissolving the foam insert in a solvent) as soon as the water disappears from the cast block and the green body is formed. This is necessary to avoid any build-up of stress due to the drying shrinkage of the cast green body. These facts are established in the Li reference itself without any need for other evidence. Moreover, the Examiner's proposed modification of Li, i.e. to perform a machining operation while the inner

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mold remains in place, would certainly destroy the intent, purpose and function of the Li invention because it would significantly delay the removal of the inner mold. Accordingly, no *prima facie* case for this rejection under 35 USC 103 has been made, and the rejection should be overturned.

The Examiner further states that it would have been obvious to modify the method of Li with the method taught by Owen to apply a fibre ceramic composite to a layer of ceramic insulating material. However, as taught by the Li reference itself, it is essential to Li to remove the inner mold quickly, and thus the modification of the method of Li to add the fibre application steps of Owen would destroy the intent, purpose and function of the Li invention because it would significantly delay the removal of the inner mold. Thus, no *prima facie case* for the rejection under 35 USC 103 has been established and the rejection should be overturned.

Arguments applicable only to claim 13:

Dependent claim 13 includes the further limitations of "at least partially curing the layer of ceramic insulating material while the inner mold remains in place." The Examiner argues on page 9 of the final Office Communication that the method of Li "intrinsically at least partially cures the layer of ceramic insulation material prior to removing the inner mold." The Examiner's position is erroneous. Li clearly teaches at column 2, lines 49-64 that his inner mold is removed very rapidly.

"As soon as the water disappears from the top of the slip-cast block, the green body, silicon nitride block is removed from the mold, box 20, and then immersed in a solvent for dissolving the insert, box 22. The solvent ... dissolves the polystyrene foam insert in less than 10 seconds."

Not only is this time frame extremely limited, but there is also no teaching of heating the green body ceramic material to an elevated curing temperature during this 10 second period. Thus, it is impossible for the ceramic material to partially cure prior to the removal of the inner mold, and no *prima facie* case for the rejection of claim 13 under 35 USC 103 has been established. This provides an additional basis for overturning this rejection of claim 13.

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D. Why the combination of Cornie and Ross or Kobashi fails to support the 35 USC 103 rejections of claims 2, 3 and 10-18

Arguments applicable to all claims in this group (2, 3 and 10-18):

i) Independent claim 11 is exemplary of this group of claims in that it includes the limitation of "performing a mechanical process on the layer of ceramic insulating material while the inner mold remains in place for mechanically supporting the layer of ceramic insulating material." The inner mold is removed in a later step of the claim after the mechanical process is performed. Cornie fails to describe any such mechanical process being done while an inner mold remains in place. The addition of Ross or Kobashi fails to rectify this deficiency of the prior art.

On page 10 of the final Office Communication where the Examiner provides detailed line and page references from Cornie to explain where he draws support for the teaching of the various claim limitations, it is conspicuous that no line or page reference is provided to cite specifically where Cornie teaches the above-cited claim step. Several lines later, at the bottom of page 10, the Examiner does cite several sections of Cornie, however, these sections do not provide the required support for the rejection, as follows:

- page 4, lines 19-24 states that the order of steps is immaterial so long as the invention remains operable
- page 6, lines 16-25 provides a definition of "net-shape"
- page 25, lines 20-28 describes various machining and processing steps that are performed after the cast part is recovered from the mold. None of these steps involve machining a layer of ceramic insulating material to a predetermined thickness.

Thus, no *prima facie* case has been established for this rejection under 35 USC 103 and the rejection should be overturned.

8. CLAIMS APPENDIX - 37 CFR 41.37(c) (1) (viii).

A copy of the claims involved in this appeal is attached as a claims appendix under 37 CFR 41.37(c) (1) (viii).

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9. EVIDENCE APPENDIX - 37 CFR 41.37(c) (1) (ix)

None is required under 37 CFR 41.37(c) (1) (ix).

10. RELATED PROCEEDINGS APPENDIX - 37 CFR 41.37(c) (1) (x)

None is required under 37 CFR 41.37(c) (1) (x).

Respectfully submitted,

Dated: 8/6/2007

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APPENDIX OF CLAIMS ON APPEAL

1. A method of manufacturing comprising:
defining a cavity between an inner mold comprising a fugitive material portion and an outer mold;
casting a layer of ceramic insulating material within the cavity;
removing the outer mold;
performing a mechanical process on the layer of ceramic insulating material while the inner mold remains in place for mechanically supporting the layer of ceramic insulating material;
and
removing the fugitive material and removing the inner mold;
wherein the step of performing a mechanical process comprises machining the layer of ceramic insulating material to a predetermined thickness.

2. The method of claim 1, further comprising applying a layer of ceramic matrix composite material to the layer of ceramic insulating material prior to the step of removing the fugitive material and removing the inner mold.

3. The method of claim 2, further comprising:
removing the inner mold after the step of applying a layer of ceramic matrix composite material; and
performing a mechanical process on an inside surface of the layer of ceramic insulating material.

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5. The method of claim 1, wherein the cavity is defined to have a thickness dimension selected to facilitate the step of casting, and wherein the step of performing a mechanical process comprises machining an outer surface portion of the layer of ceramic insulating material to reduce a thickness dimension of the layer of ceramic insulating material to less than the thickness dimension of the cavity.

6. The method of claim 1, wherein the inner mold defines a net shape desired for the layer of ceramic insulating material.

7. The method of claim 1, further comprising at least partially curing the layer of ceramic insulating material prior to removing the inner mold.

8. A method of manufacturing comprising:
defining a cavity between an inner mold comprising a fugitive material portion and an outer mold;
casting a layer of ceramic insulating material within the cavity;
removing the outer mold;
performing a mechanical process on the layer of ceramic insulating material while the inner mold remains in place for mechanically supporting the layer of ceramic insulating material;
removing the fugitive material and removing the inner mold;
at least partially curing the layer of ceramic insulating material after the inner mold has been removed; and
installing a second inner mold comprising a fugitive material portion for supporting the ceramic insulating material during a subsequent process step.

9. The method of claim 8, wherein the fugitive material portion of the inner mold used during the step of casting comprises a material different from the fugitive material portion of the second inner mold.

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10. The method of claim 8, further comprising applying a layer of ceramic matrix composite material to the layer of ceramic insulating material after the second inner mold is installed.

11. A method of manufacturing a gas turbine component comprising a ceramic matrix composite material member defining a passageway and a layer of ceramic insulating material protecting the ceramic matrix composite member from high temperature gas passing through the passageway, the method comprising:

defining an annular cavity having a first thickness dimension between an inner mold and an outer mold;

casting ceramic insulating material within the cavity to have a first thickness dimension;

removing the outer mold;

removing a portion of the ceramic insulating material to reduce the ceramic insulating material to a second thickness dimension smaller than the first thickness dimension while the inner mold remains in place mechanically supporting the ceramic insulating material;

forming a layer of ceramic matrix composite material on an outer surface of the ceramic insulating material; and

removing the inner mold.

12. The method of claim 11, further comprising:

forming the inner mold to have a fugitive material portion; and

transforming the fugitive material portion prior to the step of removing the inner mold.

13. The method of claim 11, further comprising at least partially curing the ceramic insulating material while the inner mold remains in place prior to the step of removing a portion of the ceramic insulating material.

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14. The method of claim 11, further comprising:
performing the step of defining an annular cavity using a first inner mold;
removing the first inner mold after the step of casting;
at least partially curing the ceramic insulating material after the step of removing the first inner mold; and
installing a second inner mold for supporting the ceramic insulating material prior to the step of removing a portion of the ceramic insulating material.
15. The method of claim 14, further comprising forming the second inner mold of a material different than a material of the first inner mold.
16. The method of claim 11, further comprising performing a mechanical process on an inside surface of the ceramic insulating material after the step of removing the inner mold.
17. The method of claim 11, further comprising forming the inner mold to have a net shape desired for the passageway.
18. The method of claim 11, further comprising forming the first thickness dimension to be at least 15 mm and removing a sufficient portion of the ceramic insulating material to reduce the ceramic insulating material to a thickness of 3-8 mm while the inner mold remains in place.

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EVIDENCE APPENDIX

None.

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RELATED PROCEEDINGS APPENDIX

None.